

INTRODUCING THE CELL

1 videocassette, 21 minutes long

Copyright MCMXCV
RAINBOW EDUCATIONAL MEDIA

Distributed by:
United Learning
1560 Sherman Ave., Suite 100
Evanston, IL. 60201
800-323-9084
www.unitedlearning.com
www.unitedstreaming.com



CREDITS

Author and Producer:	Peter Cochran
Director of Photography:	Peter Scheer
Graphics and Animation:	Roger Meyer
Production Coordinators:	Kathy Kavanaugh Elisa Zazzera
Narrators:	Richard Cassell Randy Kaye
Consultants:	Michael Worosz Gregg Rice, Ph.D.
Stock Video:	BioMedia Associates Cold Spring Harbor Laboratories Encyclopaedia Britannica European Space Agency National Park Service Photo Researchers, Inc.
Post Production:	North Country Media
Audio Sweetening:	Acme Recording Studios

Produced for Rainbow Educational Media by
Cochran Communications

TABLE OF CONTENTS

Introduction	!
Program Summary	1
Learning Objectives	3
Review Questions	4
Activities	6
Glossary	9
Bibliography.....	12
Related Videos from Rainbow.....	12
Script	13

INTRODUCTION

Cells are both the building blocks and factories of life. All living things—from protozoa and bacteria to whales and giant redwoods—consist of cells. Inside cells, protein products are manufactured and nutrient molecules are burned for energy. Cells also contain the genetic instructions that determine what we look like.

Introducing the Cell provides a basic overview of what cells are and how they function. It examines many of the parts of cells. It offers fascinating views of different kinds of plant and animal cells, focusing in particular on some of the cells of the human body.

The video uses a variety of techniques to be both informative and entertaining. The narration alternates between a female and a male narrator. Students see a variety of photographs, taken with the aid of light and electron microscopes, of different cells and cell parts. Graphics and animation clarify important concepts. In addition, examples are used that relate to the students' own bodies.

The program is designed for grades five through seven, but older audiences can find it useful as well.

SUMMARY

The opening shows a variety of life forms. The video states that all living things share a fundamental characteristic. They are all composed of cells.

After the title the video compares cells to bricks that make up a house or building. Bricks that are the same size can make up structures that are very different in size. In a similar way, how big a living thing is depends not on how big its cells are but on how many cells it has.

The video then goes on to show how most cells are very small and can be seen only with the help of a microscope. It describes the differences between a light microscope and an electron microscope.

The program next compares cells to factories. Inside cells there are thousands of chemicals that are involved in making useful products, and acquiring and using energy.

The video describes some of the parts of a typical animal cell, including the cell membrane, endoplasmic reticulum, nucleus, mitochondria, lysosomes, and Golgi bodies. It then describes the major differences between animal cells and plant cells, which have a thick cell wall. The video describes in simple terms how photosynthesis takes place in chloroplasts.

The program then shows how different cells have specialized architectures that help perform particular tasks. Examples of plant cells include root cells and xylem cells. Examples of human cells include skin cells, nerve cells, muscle cells, bone cells, red blood cells, and white blood cells.

A summary reiterates the major points of the program.

LEARNING OBJECTIVES

After viewing the program, students will be able to:

1. describe how the cell is the basic unit of life.
2. name and describe several single-cell organisms.
3. name the basic parts of animal and plant cells and explain what they do.
4. describe how animal and plant cells are different.
5. give examples of animal and plant cells.

REVIEW QUESTIONS

1. How are cells like building blocks or bricks?

Just as a building is made of bricks, living things are composed of cells.

2. How are cells like factories?

They manufacture different products. They also require energy.

3. Name some of the organelles found in a typical animal cell and describe what they do.

Organelles mentioned in the video include:

- the nucleus, which contains the cell's genetic material and is the cell's control center.*
- the cell membrane, which surrounds the cell and lets certain substances enter or leave the cell.*
- the endoplasmic reticulum, where proteins are assembled and which act as a transport network,*
- lysosomes, which digest food particles and act as the cell's garbage disposal units.*
- Golgi bodies, which package materials before they leave the cell.*
- mitochondria, the power plants of the cell.*

4. How are plant cells different from animal cells?

Plant cells have a cell wall surrounding the cell membrane.

Many plant cells have chloroplasts. Many also have large vacuoles.

5. What is photosynthesis?

Photosynthesis is the process by which certain plant cells use the energy of sunlight, carbon dioxide, and water, to produce glucose and oxygen.

6. Describe several plant cells.

Examples in the video include:

- root cells that have hair-like extensions that take in water and minerals from the soil.*
- phloem cells that conduct food.*
- xylem cells that conduct water.*

7. Describe different animal cells and what they do.

Example in the program include:

- muscle cells, which expand and contract;*
- nerve cells, which conduct signals;*
- bone cells, which secrete hard material;*
- skin cells, which provide a protective barrier;*
- red blood cells, which carry oxygen to other cells throughout the body;*
- white blood cells, which help protect us from disease.*

ACTIVITIES

1. Prokaryotic and eukaryotic cells.

The program describes eukaryotes, cells which have a nucleus. Prokaryotes are cells that don't have a distinct nucleus. Prokaryotes include bacteria and blue-green algae.

Ask students to research and report on the differences between prokaryotic cells and eukaryotic cells.

2. Report on a cell

The program describes how different types of cells have distinctive architectures and do specific jobs.

Ask the students to choose a type of cell and write a report on it. In their reports they should include how the cell has special features that help it perform specific tasks. They should include illustrations of the cell and its various parts.

Among the kinds of cells they could report on are:

- different kinds of sensory nerve cells
- sperm cells
- egg cells
- fat cells
- different types of leaf cells

3. Observing Onion Cells

For the activity described below, you will need:

- compound microscope
- paring knife
- medicine dropper
- dilute iodine
- fresh onion

Procedure: Using the medicine dropper, put a drop of iodine diluted with water on a glass slide. Using the paring knife, cut a thin slice of onion and place it in the iodine on the slide. Put a slip cover over the slide.

Ask the students to take turns observing the onion skin under high power and comment on what they see. If there is time, you also could ask them to make a sketch of what they see.

Students should be able to observe many rectangular boxes with dark spots in them. The boxes are cells, and the spots are nuclei.

4. Observing Elodea Cells

For this activity you will need:

- compound microscope
- medicine dropper
- tap water
- elodea plant (obtainable from a pet supply store)

Put two drops of water on a clean glass slide. Tear off a single green leaf from the stem of the elodea plant, place it on the slide, and cover with a coverslip.

Ask the students to take turns observing the elodea leaf under high power and to comment on what they see. If there is time, you could also ask them to make a sketch of it.

Students should be able to observe many rectangular boxes with small green ovals in them. The boxes are cells and the green ovals are chloroplasts, where photosynthesis takes place.

5. Early History of the Discovery and Observation of Cells

Cells were first observed by Robert Hooke, an English scientist who examined cork cells with a primitive microscope. Hooke named what he saw after the cells of a honeycomb.

Students can research and report on Hooke and other early scientists who contributed to our understanding of cells. Examples include Matthias Schleiden, a German botanist who proposed that all plants are made of cells; and Theodore Schwann, a German zoologist who proposed that all animals also are composed of cells.

GLOSSARY

actin: movable protein filament found in the myofibrils of muscle cells.

amoeba: single-cell organism.

axon: fiber that conducts signals away from the cell body of a nerve cell.

cell: basic unit of life.

cell membrane: outermost membrane of the cell

cell wall: rigid structure of nonliving material that surrounds the cell membrane of plant cells.

chloroplast: organelle that is the site of photosynthesis.

chromosomes: structures that carry genetic information.

cilia: tiny hairlike projections of cytoplasm.

cytoplasm: living matter within a cell, excluding the nucleus.

dendrites: fibers that conduct impulses toward the cell body of a nerve cell.

electron microscope: microscope that uses electrons rather than visible light to create a magnified image.

endoplasmic reticulum: network in the cytoplasm that forms a transport system within a cell.

epidermis: thin outer layer of skin.

euglena: single-cell organism.

flagella: whip-like extensions of some organisms that provide locomotion.

Golgi body: organelle that is involved in the packaging of materials for secretion from the cell.

light microscope: microscope that uses visible light to create a magnified image.

lysosomes: organelles involved in the digestion of food particles.

mitochondria: organelles that are involved in energy-producing functions.

myosin: protein filament found in the myofibrils of muscle cells.

neuron: nerve cell.

nucleus: spherical body that is the control center of the cell and contains chromosomes.

organelles: microscopic structures inside a cell that have special functions.

paramecium: single-cell organism.

phloem cells: plant cells that primarily conduct food.

photosynthesis: process by which green plant cells produce their own food and oxygen.

pseudopod: temporary extrusion of an amoeba that provides locomotion.

tissue: group of cells that perform the same function.

vacuole: storage sac that is found in many cells.

xylem cell: plant cells that conduct water, and other materials, upward in a plant.

BIBLIOGRAPHY Curtis,

Helena. *Biology*. New York: Worth, 1979.

Giese, Arthur C. *Cell Physiology*. Philadelphia: Saunders College Publishing, 1979.

Barnard, Christian. *The Body Machine*. New York: Crown Publishers, 1981.

Caselli, Giovanni. *The Human Body and How It Works*. New York: Grosset & Dunlap, 1987.

Eltig, Mary. *The Macmillan Book of the Human Body*. New York: Macmillan Publishing Co., 1986.

Hanauer, Ethel. *Biology Experiments for Children*. New York: Dover Publishers, 1962.

Kraus, David. *Concepts in Modern Biology*. New York: Globe Book Company, 1984.

Rand McNally Biology Encyclopedia. New York: Rand McNally 1985.

RELATED VIDEOS FROM RAINBOW

Cell Division

In Control: Our Brain and Nervous System

Our Flexible Frame: The Skeletal and Muscular Systems

Breath of Life: Our Respiratory System

Food into Fuel: Our Digestive System

Pumping Life: The Heart and Circulatory System

SCRIPT

Female Narrator:

In the frigid seas off Alaska, whales break the surface to breathe life-sustaining air.

In a pond in Illinois, a microscopic amoeba constantly changes its shape as it moves through the water.

An emerald tree boa in the Amazon rain forest slides noiselessly along a branch, looking for prey...

while a flower decorates a garden in New York. Life

on earth has many sizes, shapes and shades;

but no matter what they look like, all living things share a characteristic that makes them more alike than different.

All living things are-made of cells, the basic units of life.

Title: Introducing the Cell

Male Narrator:

In some ways cells are like the bricks that are used to build a house or building.

How these bricks are put together and how many bricks are used determine the size and shape of the structure.

There may be tens of thousands of bricks in a multistoried apartment building;

but bricks that are the same size are the basic materials for much smaller structures, like a two-story house.

In a similar way, the size of a living thing depends not on how big its cells are but on how many cells it has. A whale has trillions of cells;

but on average these cells are no larger than the cells in a bumble bee.

Most cells are very small. If the average-size cell in your body were a quarter-inch across,

you'd be taller than most skyscrapers.

Female Narrator:

While humans and many other living things are composed of billions of cells, there also are tiny living things that consist of only a single cell.

An amoeba, has no definite shape. It moves by extending fingerlike extensions, called *pseudopods*, from the rest of its cellular body, which then follows.

Other single-cell creatures, euglena, propel themselves through the water with their whip-like flagella,

while paramecia have bodies lined with hair-like cilia that beat together.

Light microscopes let us see such creatures and other kinds of cells by using lenses to focus rays of light in such a way that a magnified image is created.

Light microscopes let you see cells and even some of their different parts, but they can't let you examine these parts in detail.

An *electron* microscope is much more powerful. Using magnets to focus beams of electrons, electron microscopes can magnify things hundreds of thousands of times.

Using electron microscopes, scientists can examine the details of even small cell parts.

Male Narrator:

Understanding what goes on inside cells is necessary for understanding how any living thing functions.

Cells perform an amazing array of tasks that are necessary for living things to exist.

In fact, while cells are like building blocks, they are also like factories.

Like factories, cells do a great deal of work. Just as an automobile assembly line puts together cars, from different parts, cells use raw materials to manufacture things a body needs...like new cells and various chemicals.

Like factories, cells require a lot of energy to function;

and just as different sections of a factory perform different jobs, cells have a variety of parts that do separate jobs.

Female Narrator:

There are many kinds of animal and plant cells that have different architectures and do different things;

but many of the parts of these different cells are the same and have the same functions.

If we created a typical animal cell, it might look something like this. Even though no specific animal cell looks exactly like this one, it contains features shared by most such cells.

Surrounding the outside of the cell is the *cell membrane*. This membrane is very thin, only about one one hundred thousandth of a millimeter thick.

A photograph of a cell membrane, taken with the help of an electron microscope, reveals that it has three layers, two dark outer layers sandwiching a clear middle layer.

The cell membrane acts as a boundary between a cell and the environment outside, but it also allows certain substances to pass in and out.

Particles of food, for example, can enter through the membrane so that they can be used as raw materials for manufacturing and as fuel for energy.

Oxygen can, also, enter a cell to be used for burning fuel.

Other things pass out of the cell through the membrane, including waste, like carbon dioxide gas, and important chemical products that the cell has manufactured.

Male Narrator:

Inside the cell membrane there are many different structures called *organelles*, which literally means little organs.

One organelle, the *nucleus*, is the control center of the cell. The nucleus has a membrane that has pores in it. These allow certain molecules to enter or leave the nucleus.

Inside the nucleus, there is fiberlike material called chromosomes. Chromosomes contain the cell's genetic information.

This genetic information is like an architect's blueprint that determines how wood, glass and other materials are used to build a house.

The genetic blueprint in a person's chromosomes determine how different proteins are put together.

These proteins are responsible for physical features such as the color of a person's hair and eyes,

the shape of her nose,

and even whether she is susceptible to certain kinds of diseases.

Female Narrator:

From the information contained in the chromosome blueprints, the nucleus sends messages to the cell's *cytoplasm*,

which makes up everything else that is inside the cell. The cytoplasm is composed of water, minerals, vitamins, salts, a variety of chemicals, as well as different organelles.

Some of the organelles are called *endoplasmic reticulum*. Among other things, the endoplasmic reticulum serve as the cells assembly lines because they are where protein products are put together based on instructions from the nucleus.

The endoplasmic reticulum serve other functions as well. They are like highways that provide a transportation network. Among other things, they connect different organelles in a cell and allow them to exchange materials.

Male Narrator:

Mitochondria are another kind of organelle in the cytoplasm.

Inside a mitochondrion there are highly-folded membranes. Here chemical reactions take place that use oxygen to burn particles of food for energy.

Mitochondria are often called the powerhouses of the cell, because they are responsible for providing for the cell's energy needs.

The number of mitochondria varies in different kinds of cells. Very active cells, like muscle cells, contain thousands of mitochondria.

Female Narrator:

Before particles of food can be burned in mitochondria, they are first processed by other organelles called *lysosomes*. These contain chemicals, called enzymes, that digest small food particles that have passed into the cell.

Lysosomes also are the garbage disposal units of the cell. They break down worn-out cell parts and gather waste products from the cell's cytoplasm.

Another kind of organelle, the *Golgi bodies*, are the cell's packaging centers. Here proteins are mixed with other chemicals and enclosed in bubblelike containers that then break away and move to the cell membrane, where their contents are released from the cell.

Male Narrator:

Plant cells share many of the same features as animal cells. They, too, have a nucleus, mitochondria, endoplasmic reticulum, Golgi bodies, and lysosomes;

but plant cells are different from animal cells in other respects.

For one thing, while plant cells, like animal cells, have a cell membrane, they also have a thick *cell wall* surrounding this membrane.

Many plant cells also have large sacs called *vacuoles*. A vacuole contains fluid consisting of water, sugars and other things. A vacuole full of fluid is like a balloon full of water and keeps a plant cell rigid.

When the vacuoles of plants' cells lose their fluid and dry out, the cells can no longer provide rigid support. As a result, the plant wilts.

Female Narrator:

Many plant cells, particularly in leaves and stems, have tiny green bodies in them, called *chloroplasts*.

Chloroplasts make it possible for plants to manufacture their own food through *photosynthesis*.

Photosynthesis requires energy from sunlight. It also requires carbon dioxide gas from the atmosphere and water that, for most plants, comes from the soil. Inside chloroplasts the energy of sunlight is used to convert carbon dioxide and water into glucose, a kind of sugar that is a plant's, main food. In the process, oxygen gas is also produced. The oxygen that we breathe comes from photosynthesis.

Male Narrator:

Living things that are composed of many cells usually have different types of cells. These have different designs that help them perform specific jobs.

Not all plant cells, for example, have chloroplasts. Cells in roots are not involved in photosynthesis, and they don't have chloroplasts;

but some root cells have an unusual architecture that serves a plant in other ways. These cells have root hairs, delicate projections that can absorb water and minerals from the soil, that the plant needs.

Other cells serve as a plant's plumbing system. This cross section of a root shows different kinds of hollow cells. Phloem cells conduct glucose from the plant's leaves. Xylem cells conduct water from roots to other parts of the plant.

A photograph taken with the help of an electron microscope shows how xylem cells have a tube-like architecture.

Female Narrator:

In plants and animals similar cells are grouped together to form tissues. The human body is made up of many different kinds of tissue.

Groups of bone cells, for example, form bone tissue, and muscle cells form muscle tissue. The different types of cells that make up the tissues of the human body have distinctive architectures.

Take the cells that form the epidermis, the thin outer part of the skin.

The epidermis consists of several layers of cells that fit closely together. They provide an effective barrier against bacteria, and other things could cause harm if they got inside the body.

The top layer consists of dead cells that are constantly being rubbed off and replaced by cells from below.

Male Narrator:

The muscles attached to the skeleton have cells that look very unlike skin cells. Muscle cells are very long and fiber-like.

Each cell contains many fine threads called myofibrils.

Myofibrils, in turn, contain two types of even smaller filaments called actin and myosin.

A closer look at the actin and myosin shows how they can slide over each other, making it possible for a muscle cell to contract and expand.

Thousands of muscle cells contract and expand together, making it possible to move an arm or leg.

Bone cells serve a different function. Bone cells secrete calcium and other materials that harden and form the body's bones.

Female Narrator:

When we think, or try to solve a problem, we're using other kinds of cells,

nerve cells, which are also called neurons. There are billions of neurons in the brain alone, and these can communicate with other nerve cells that branch throughout the body, forming the body's nervous system.

The architecture of nerve cells varies according to what function they serve, but all have the same basic design. Each consists of a single-cell body which contains the cell's nucleus.

Branching out from the cell body are fibers of different lengths, called dendrites.

There is also a single long fiber called the axon. In some cells, the axon is very long, up to three feet.

Signals race from the dendrite of one cell, through the cell body, and along the axon. At the end of the axon the signal is picked up by the dendrite of another nerve cell.

Together, the billions of nerve cells in the body form an intricate communications network that makes possible our thoughts and senses.

Male Narrator:

A drop of blood tells another story about cells. •

The blood that flows through the veins and arteries of the body's circulatory system contains different kinds of cells that perform jobs vital to our existence.

Red blood cells are the most numerous. They look a little like doughnuts with their centers filled in.

Red blood cells carry oxygen from the lungs to other cells throughout the body.

There are about 25 trillion blood cells in the body of an adult. Each has a life span of only about 125 days, so new ones are constantly being produced at the incredible rate of about 2 million a second.

Blood also contains white blood cells. Although much fewer in number, white blood cells are important defenders of the body against invaders like disease-causing bacteria.

Some white blood cells actually engulf bacteria and other harmful things, making them harmless by eating them.

SUMMARY

Female Narrator:

In this program we've seen how all living things are made up of cells.

Some-like an euglena-consist of only a single cell.

Others are made up of trillions of cells. **Male**

Narrator:

We looked at a typical animal cell and some of the functions of its different parts.

The nucleus is the cell's control center. The chromosomes inside the nucleus contain the genetic blueprint that determines how proteins are manufactured.

Mitochondria are the cell's power plants;

and lysosomes digest particles of food and are the cell's garbage disposal units.

Female Narrator:

We compared animal cells to plant cells, which have a thick cell wall and large vacuoles.

Many plant cells also have chloroplasts, where through photosynthesis plants use the energy of sunlight and

carbon dioxide gas to manufacture their own food and also produce oxygen.

Male Narrator:

We saw that many plants and animals-including humans-have an amazing variety of cells that perform different jobs.

In our own bodies, nerve cells make it possible for us to think.

Muscle cells can relax and contract, enabling us to move.

Red blood cells carry life-sustaining oxygen through our circulatory system;

and white blood cells help protect us from disease.

Female Narrator:

All living things are the sums of their cells. Cells are the building blocks and factories of life.

END